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Variable Audio Bandpass Filter

Eric Edwards GW8LJJ describes an audio bandpass filter that can be a useful add-on to a homebrew receiver or transceiver.

There is a lot of noise on HF radio these days and while the only effective noise limiter is usually of the DSP (Digital Signal Processing) type, some improvement can be made with a lowpass filter to cut off the HF response. Many receivers have one fitted, typically switchable enabling the HF to be cut at selected frequencies. When building your own receiver, perhaps a direct conversion type, then that could also suffer from low frequency noise such as mains hum and a highpass filter (HPF) as well as a lowpass filter (LPF) will be very useful. The project described is a variable low- and highpass filter with roll-offs from 40Hz and up to 200Hz and with a lowpass filter that has sharp, brick wall, cut-offs from 200Hz to 4MHz.

This design came about when a local radio amateur asked if I could make a switched high- and lowpass filter to reduce his noise on the HF bands. I explained that while this may not do what is asked, it will certainly help in some circumstances. I decided a variable filter would be more practical, and useful, than a switched version.

The Circuit

The complete circuit is shown at **Fig. 1** and comprises three integrated circuits. The first one is one half of an NE5532 Op Amp (IC1a) and is the HPF with the variable control roll-off adjustment from 40Hz to 200Hz. The output is taken to a MAX294 (IC2), which is a switched capacitor type LPF. I have fitted a dual varicap diode in series with a capacitor from pin 1 and by varying the LPF potentiometer a sharp, brick wall type cut-off is available from 200Hz to 4MHz. I have made the 4MHz setting available for listening to wideband signals if necessary. The output of IC2 is now a bandpass filter (BPF) and a filter IC1b, is used to remove any clock oscillator frequencies emitting from the MAX294. The output of this filter is amplified to a suitable level to drive a loudspeaker at good volume. I have used an LM380 (IC3) for this because it is a very good and powerful audio circuit. Note that the pin connections are for the 8-pin version of the LM380. The volume control I have used in my unit is a preset and is set for the same

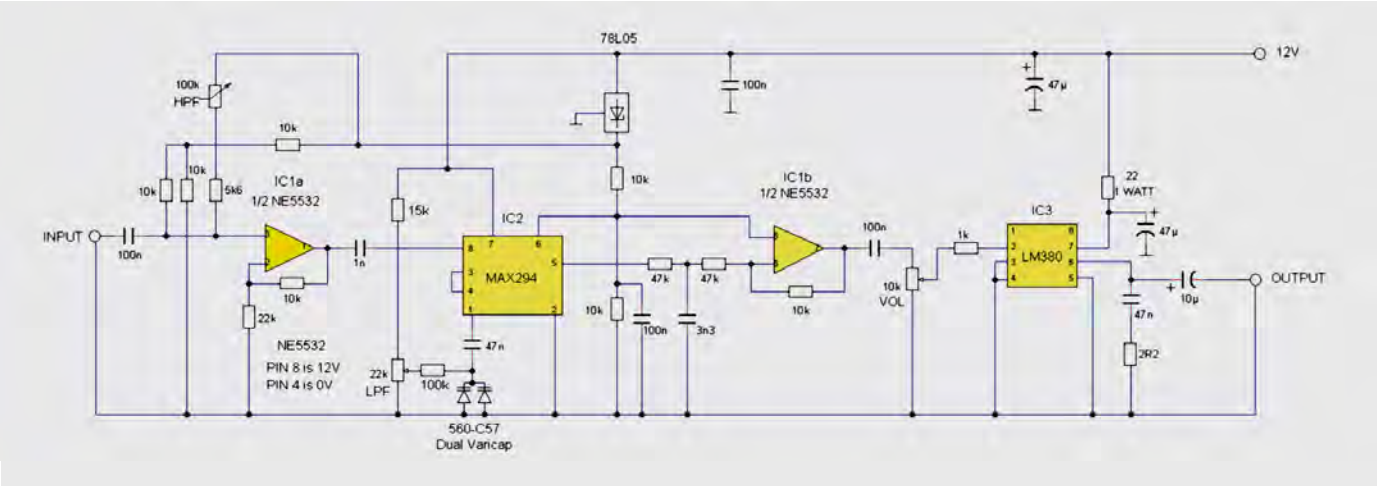

Fig. 1: The complete circuit diagram.

level output as the input from the shack receiver but this can be brought out to the front panel if required. The 78L05 regulator is to provide bias for IC1 and IC2 because they are operating on a single supply. Normally these devices would be used with a positive and negative supply and then no bias would be needed.

The PCB

The PCB as shown fitted in the enclosure in **Fig. 2** is a prototype but the actual final PCB, **Fig. 3**, follows the circuit diagram. While I am not offering this project as a kit, I can supply the PCB and any parts you do not have in the 'junk box'.

In Use

This is simple to use and just requires a 12V power source and an output from a headphone socket of the shack receiver set to a level just a bit lower than the normal listening level. This is to prevent circuit overload and can be adjusted when a signal is received. Connect either headphones or a loudspeaker to the output connector; turn the HPF control fully counter-clockwise and the LPF to fully clockwise. This will set the filter to maximum bandwidth. Set the volume control to mid-way. On receiving a signal, the volume in the unit along with the level from the receiver can be set for a comfortable listening level. Adjusting the LPF counter-clockwise will reduce the HF and consequently the HF noise. If listening to a CW transmission, it may be useful to turn the HPF control clockwise to a level that sounds the best and further adjusting the LPF control for quality CW reception. For use with homebrew receivers, the HPF will be very useful for removing hum and any other low frequency noises.

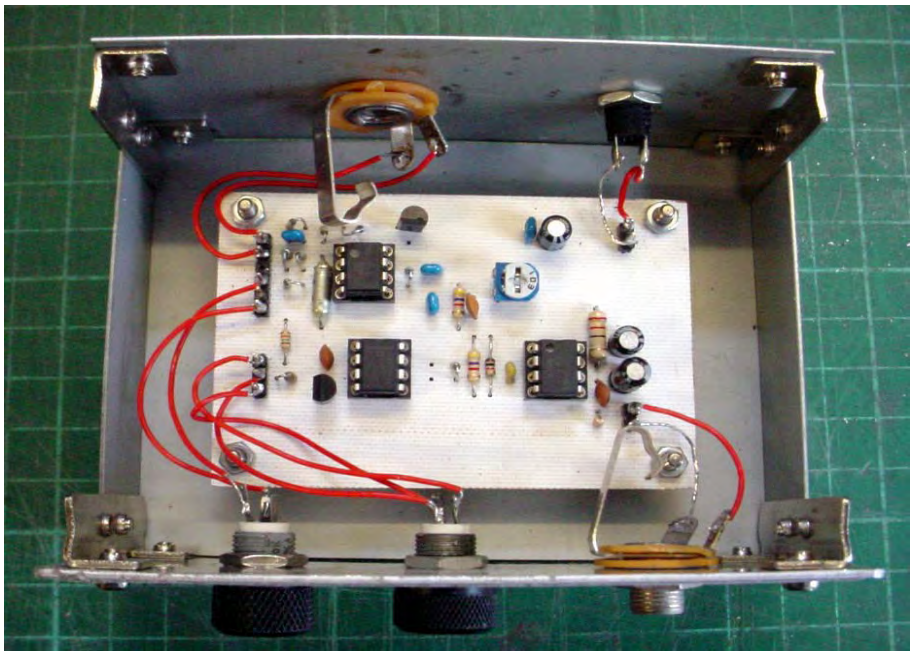

Fig. 2: The prototype PCB fitted in the enclosure.

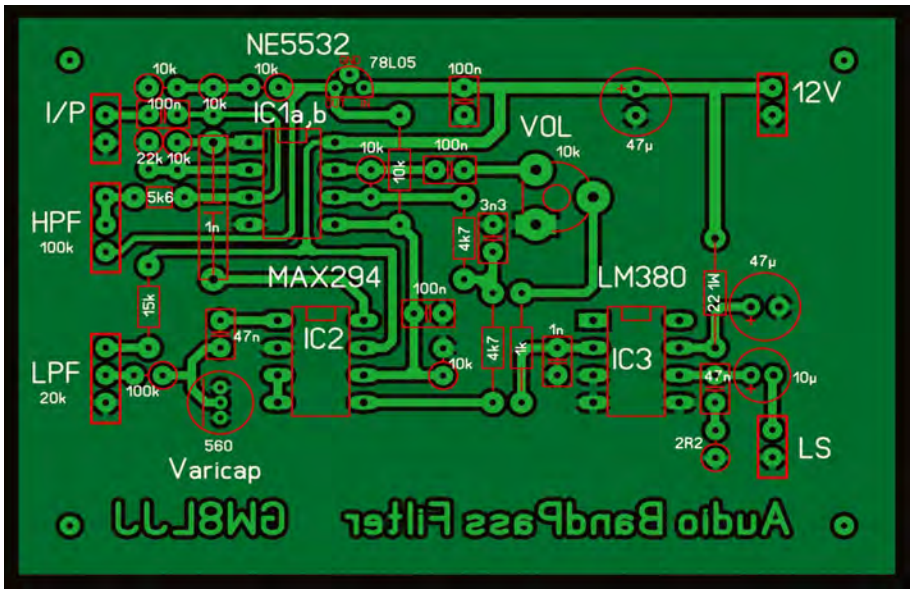

Fig. 3: The final PCB (not actual size).